

SUBJECT AND METHODS

The present study essentially attempts longitudinal data on a group of children for anthropometry as well as dietary intake. While anthropometry is relatively easier, the longitudinal diet surveys are difficult to carry out.

Diet surveys play an important role in studying nutritional and health problems of a given community. For example, diet surveys are usually carried out to compare the average nutrient intakes of different groups or to identify nutritional deficiencies or to study association of nutrition with growth.

The measurement of habitual food intake of an individual is a difficult task. Measuring diet of an individual accurately requires high degree of skill, care and dedication on the part of the investigator. Conducting diet surveys in the field are even more difficult than conducting them in the in-patient studies.

For this study i.e. for estimating nutritional intakes of adolescents, selecting samples from free living populations would have been difficult as the food samples

vary from house to house and the work of food analysis becomes unmanagable. It was therefore decided to consider students studying in the hostels, so that large number of study population could be covered. Thus it would be easier to obtain large sample of school children would will be eating in the same kitchen. Hence, for this particular project, study population has been school going adolescent boys residing in the hostels.

Schools having hostel facility were contacted. While selecting the schools, our main intention was to have representation of different socio-economic classes. The co-operation of the school and hostel authorities was ensured through discussions before finally selecting the school. Finally two schools having hostel facility and representing low and middle socioeconomic class were selected.

The school catering to the needs of low socioeconomic (LSE) group was a Marathi Medium School having hostel facility. Boys living in this hostel were generally from the villages and from poor families. Children had to do a lot of work in this hostel to get education, food and place to live. Monthly fee for this hostel was very meagre and it ranged from Rs.40/- to Rs.120/-. Total number of 122 boys living in this hostel were considered for anthropometric measurements

and out of these 122 boys, 69% boys (i.e. 84) were included in the diet survey.

Another school catering to the needs of children from middle socioeconomic (MSE) group, was also a Marathi Medium School having hostel facility. Boys from this hostel also came from nearby villages but were from the rich families. Fathers of these children were generally owners of large acres of land. Monthly fee for this hostel was Rs.500/-. In all 63 boys living in this hostel were included in both diet and anthropometric survey.

One more school catering to the needs of children from high socioeconomic (HSE) group was selected but did not have a hostel facility. This was mainly for comparing anthropometric measurements of children from different socioeconomic groups. This was an English Medium School. Parents of these children were generally professionals or businessmen or serving at high posts. In all 184 boys from this school were considered for anthropometric survey. Although, actual dietary intake of these boys was not measured, diet history of all boys from HSE group was recorded with the help of a questionnaire.

All the boys included in this study were followed up for anthropometry for one year in which they were measured four times at the interval of three months for boys from LSE and MSE group. Number of children covered in various rounds are given in Table 2.1.

Table 2.1 : Number of children covered for anthropometric and diet survey in various rounds undertaken.

Information on	HSE			MSE				LSE			
	R1	R2	R3	R1	R2	R3	R4	R1	R2	R3	R4
Anthropometry	183	184	179	61	60	58	44	122	117	115	115
Diet	-	-	-	61	60	58	-	84	78	74	51

2.1 Methodology

Field surveys are of various types and they should be chosen in the light of the objectives of the study. As our interest was to study variations in intake as well as in anthropometric measurements, it was essential to follow the same subjects over a period of time. Cross sectional surveys are not useful in this case as they do not give any idea about individual variation, and in the period of adolescent growth individual variations are known to be quite large.

The present study is thus a longitudinal study in which, the same subjects were followed up for three times for boys from HSE group and four times for boys from LSE and MSE group for anthropometry and diet survey. The measurements recorded and the methods used are discussed below.

2.1.1 Anthropometric Measurements

Anthropometric measurements are used to assess the variations in the physical dimensions of an individual. Various anthropometric measurements can be used, out of which four measurements such as body weight, height, triceps skinfold thickness and chest circumference were selected.

Body Weight

Weight is the anthropometric measurement most in use. It indicates current nutritional status of an individual. Serial measurements of weight of children are even more important than a single observation. Using serial measurements, information regarding yearly increment in weight can be obtained which has its importance in the growth study of children. By taking weights of children for 3 to 4 times a year, we could also be able to study variations in increments in body weights of children from different socio-

economic classes. Body weight can also be used for calculating various nutritional indices such as weight for age, body mass index etc. It is also useful in computing body fat percent of an individual.

Body weights of children were recorded using a lever balance "Healthometer". It had the least division of 100 gms. Before taking the weights of children, the balance was checked for zero and checked for accuracy using a known weight. After taking weights of few children it was often rechecked for zero. Body weights of study populations were always recorded in the morning before the child has eaten anything. Children were asked to remove their sweaters and shoes before taking the weights. Children were usually wearing same type of clothes i.e. school uniforms in all the rounds.

Weight measurement was recorded by the same investigator through out the study period of one year.

Height

Height is an another important measurement and is considered to reflect past nutritional status. Unlike weight, however, height has some genetic influence. Nevertheless height velocities are of particular interest in

adolescent growth spurt studies. Thus repeated measurements of height of the same children over a period of one year give idea about the variations in the height velocities of adolescent boys from different socio-economic classes.

Height was recorded using a folding type height measuring rod. Smallest observation that could be recorded with the help of this instrument was 0.1 cm. Children were asked to remove shoes before recording their heights. They were asked to stand straight on the wooden board, with feet parallel and with heels, buttocks, shoulders and back of head touching the upright rod. The head was held comfortably erect. The arms were hanging at the sides in a natural manner. The head piece, a metal bar was gently lowered, making the contact with the head. Heights of the study population were measured by the same investigator throughout the study period of one year.

Triceps Skin Fold Thickness (TSFT)

Information regarding subcutaneous fat can be obtained by measuring skinfold thicknesses at various sites on the body. Often it is difficult to measure at these sites especially during field studies. Triceps is the most convenient site for measuring skinfold thickness.

TSFT was measured using Lange skinfold calipers. Least division for measuring TSFT was 1 mm. Midpoint of the left arm was first marked with the help of measuring tape. TSFT was measured while the arm of the student was hanging relaxed at the side. The skinfold parallel to the long axis was picked up between the thumb and the forefinger of the left hand, from the underlying muscle and measured at this point. TSFT of the left arm of the students were measured by the same investigator, who was experienced and trained for taking such a skillful observation, throughout the study period of one year.

Chest Circumference (CC)

Chest Circumference (CC) was measured using a tape with a least division for recording 0.5 cms. CC was also measured by the same investigator throughout the study period in order to eliminate the between investigator variation. Students were asked to remove their sweaters before taking CC measurement.

In addition to this, each child was asked whether he was suffering from any kind of illness at the time of survey.

2.1.2 Standardisation of anthropometric measurements

Before carrying out the anthropometric survey, the technique for anthropometric measurements was standardised. For this, five investigators measured ten students two times. A particular measurement was measured by the investigator who showed good consistency for taking that measurement.

In addition to this, accuracy of the weighing balance was checked by taking weights of known weights for example, 1 kg., 2 kg., etc. upto 60 kg., 65 kg.

Age distribution of the boys who completed all the rounds of anthropometry successfully, is given in Table 2.2 (on next page). From the table, it could be seen that in all 286 boys completed all the rounds of anthropometry.

2.1.3 Socio-economic Information

In addition to anthropometric measurements and dietary intake, exact birth date and socioeconomic information was recorded for each selected boy. Proforma for collecting socioeconomic information is attached herewith (Appendix 1). It included information regarding birth date, parity, father's education, father's occupation, mother's education, mother's occupation, approximate household income (monthly),

Table 2.2 : Age distribution of the boys who were present in all the rounds of anthropometry.

Age group in years in the initial round	HSE	MSE	LSE
9 - 10	2	5	-
10 - 11	26	5	-
11 - 12	46	5	1
12 - 13	31	11	25
13 - 14	34	11	31
14 - 15	15	5	17
15 - 16	4	-	12
Total	158	42	86

total members in the family, major illnesses in the childhood and finally usual pattern of diet. Birth dates were checked from the school records. This information was used to ensure that the socioeconomic variables of the three study populations selected infact differ and represent distinct groups.

2.2 Dietary Intake

Various methods can be used for measuring dietary intake of an individual. Some of the conventional methods

are records of food consumption with weights of raw food ingredients, records of food consumption with estimated weights of raw food, the daily (24-h) recall, the history and finally, food frequency methods and questionnaires.

Each method has its own advantages and disadvantages. The selection of a particular method depends upon the objectives of the study. Considering that the main objective of this study was to examine the variations in dietary intakes of individuals, conventional methods seemed to be inappropriate.

The number of days for which the dietary intake of the individual should be recorded, depends upon the precision required, the nutrient or food to be studied and the variability of the individuals concerned. However, one week's survey classifies most of the nutrients with 80% reliability or better. Hence for this particular project 6 days dietary intake of the study population was recorded once in every season. These 6 days were separated by Sunday into two periods of three days each, so that information regarding variation from week to week could be obtained. The nutrients of interest were calories and proteins.

Dietary intake of boys from MSE group was measured three times and those of boys from LSE group was measured four times in the study year. This was because boys did not appear to be familiar with the method of recording intake in the first round. Also they seemed to eat excessively, although they had limited items like rice or khichadi.

2.2.1 Details of recording dietary intake of the study population

Food eaten in the hostel could be broadly grouped into food items like wheat roti (Chapati) or jowar roti (Bhakari) or rice which gave major contribution to the total daily calorie and protein intake of the students and secondly food items like curry, vegetables, legumes etc, which had comparatively smaller contribution to the total daily calorie and protein intake.

Method for recording dietary intake of chapati, bhakari and rice of the study population

Before the diet survey, each student was given a number on a card. Each student was asked to bring his number card with him while coming to the dining hall for the meals and was asked to keep his number card in front of his plate, so that identification of the student was much easier.

All the chapaties or bhakarries to be served to the children were weighed accurately on the "Yamato" balance which had the least division of 5 gms. Chapaties were piled up in a particular order such that first chapati should come at the top of the pile. Weights of all the chapaties were recorded on a form in a serial order.

As soon as the investigator served a chapati to a particular student, his number was recorded against the weight of the first chapati by the investigator. The number of the student who took the second chapati was recorded against the weight of second chapati and so on. Similarly weights of half and one fourth of chapati or bhakari were also taken and number of the student who took the half or one fourth chapati was recorded against the weight of half or one fourth chapati in a similar manner. Rice was served in a standard bowl. Bowls filled with rice were weighed accurately on a Yamato balance. These weights were recorded on a form in a serial manner. When the first bowl was served to a student, his number was recorded against the weight of first bowl of rice by the investigator, and so on.

Afterwards exact weight of chapati/bhakari or rice consumed by a particular student could be obtained by adding

the weights of chapaties etc. taken by him at the time of each meal.

To record intake of food items like vegetables, curry, salads etc. average weights (based on five servings) of these servings were considered, as the contribution of these food items in the daily intake of proteins and calories was comparatively less. Then the number of the students and the servings offered to him of these food items were noted.

Thus, for example if a student whose number was 1 took two servings of curry and the average weight of one serving of curry was 80 gms., his total intake of the curry would be 160 gms. Leftovers, in the plate although occasional were also measured.

2.2.2 Method for estimating calories and proteins in the food eaten in the hostel :

Exact weights of raw ingredients such as rice, wheat or jowar flour, redgram or bengal gram dal, lentils, oil, groundnuts, gingelly seeds, legumes, vegetables, jaggary, sugar, tamarind etc. were recorded for the time of each meal.

Samples of each and every food item prepared for each

meal in the hostel were collected and analysed in the laboratory for moisture estimation. Moisture of the food items was always measured in duplicates. Proteins and caloric content of all food samples were estimated by using dry part of the sample and exact weights of all the raw ingredients and the food composition tables. Thus 159 food samples from MSE hostel and 252 samples from LSE hostel were analysed for protein and caloric content in the laboratory.

For each student, daily caloric and protein intake was estimated by using caloric and protein values, obtained for per 100 gms of cooked food items and the exact weight of the food item consumed.

In addition to measuring actual food intake of the study population, children were given food intake forms every day to list all the food items consumed in a day by them. These forms were collected immediately next morning by the investigator. Proforma & Sample form is attached herewith (Appendix II). From the food intake form filled by the children, information regarding food eaten outside the hostel could also be obtained.

The food eaten outside the hostel consisted of food items like fruits, ice-creams, or bakery products like

biscuits, cakes, cream rolls, toasts etc. or cooked food items like samosa, kachori, bhelpuri, masala dosa, vada sambar etc.

Average weights of all the food items eaten outside the hostel were measured by actually buying those food items, from the same shops as far as possible and then analysing them in the laboratory for protein and caloric contents. Energy estimation of such food items was done by using bomb calorimeter and protein estimation was done by using micro kjeldhal method. In all 54 miscellaneous food items from outside were estimated in the laboratory.

Age distribution of number of children who were present in all rounds of diet survey, is given in Table 2.3 (on next page). Thus 105 children were present in all the rounds of diet survey. The main reason for the drop out was leaving the school.

2.2.3 Typical day's menu in LSE hostel :

On any typical day, breakfast was served at 7 a.m. followed by lunch at 10 a.m., snacks at 3.30 p.m. and dinner at 7 p.m. in the LSE hostel. During breakfast one of the food items such as upama, pohe, chivada was served. At lunch food items offered were chapati or bhakari as staple food and

Table 2.3 : Age distribution of number of children who were present in all the rounds of diet survey.

Age group in the initial round.	MSE	LSE
9 - 10	5	-
10 - 11	6	-
11 - 12	7	1
12 - 13	12	19
13 - 14	12	18
14 - 15	10	8
15 - 16	5	2
Total	57	48

rice, one vegetable and curry. In the afternoon, snacks were served during the school recess and often consisted of a dish prepared from one of the legumes in the sprouted form. Dinner included chapati or bhakari, rice or khichadi (rice + moong dal combination), curry or kadhi, legumes or vegetables. Calories and proteins that could be obtained by consuming average amount of items are given in Table 2.4.

Table 2.4 : Typical day's menu, together with calories and proteins per unit food items, served in LSE hostel.

Time	Name of the food item	Serving	Calories/Unit serving (Kcal)	Proteins/unit serving (gms)
Breakfast	Upama/Pohe/Chivada	One	274	5.61
Lunch	Bhakari	One	410	12.50
	Rice	1 Bowl.	188	3.71
	Vegetable	1	79	2.51
	Curry	1	65	3.35
Snacks	Legumes	1	143	6.83
Dinner	Chapati	1 No	318	10.68
	Khichadi	1 Bowl.	278	10.06
	Kadhi	1	37	1.30
	Legumes	1	143	6.83
Total			1935	63.83

2.2.4 Typical day's menu in MSE hostel :

Daily meal times in MSE hostel consisted of a breakfast at 7.30 a.m. followed by lunch at 10.30 a.m., snacks at 3.00

p.m. and dinner at 7.30 p.m. Breakfast consisted of two slices of bread and a glass of milk. During lunch, the staple food was chapati and other items such as rice, legumes, curry, salads, ghee, curds and sugar. Snacks were served during the school recess. It included one of the food items like idli, dhokala, puri, paratha, chivada, laddu, shira etc. In the evening tea was served to all the children.

Dinner again included food items like chapati, rice, one vegetable, curry, chatani or pickles, ghee and buttermilk. Calories and proteins pertaining to a typical day's average consumption is shown in Table 2.5 (on next page).

2.2.5 Advantages of records of food consumption using weigh as you eat method :

Although the same ladies were preparing chapaties/roties every day, large variations in weight of a single roti were seen. For example Table 2.6 (on page no. 37) shows average weights of one chapati and standard deviation and coefficient of variation for 6 days in Round 1. From the Table it could be seen that average weight of one chapati varied from 50 gms to 61 gms. In terms of calories this

Table 2.5 : Typical day's menu together with calories and proteins per unit food items served in MSE hostel.

Time	Name of the food item	Serving	Calories/Unit serving (Kcal)	Proteins/unit serving (gms)
Breakfast	Milk	1 Glass	146	5.38
	Bread	2 Slices	93	2.96
Lunch	Chapati	2 Nos.	346	10.62
	Rice	1 Bowl	111	2.19
	Legumes	1	89	3.81
	Curry	1	69	2.92
	Salad	1 Spoon	12	0.4
	Curds	1 Small	28	1.5
	Sugar	1 Spoon	20	0.0
	Ghee	1 Spoon	45	0.0
Snacks		1	191	3.50
Evening	Tea	1 Small cup	52	0.8
Dinner	Chapati	2 Nos	346	10.62
	Rice	1 Bowl	111	2.19
	Vegetables	1	75	1.67
	Curry	1	69	2.92
	Chatani	1 Spoon	29	0.94
	Butter Milk	1 Small katori	10	0.55
	Ghee	1 Spoon	45	0.0
Total			1887	52.97

would mean that a calorie value of a single chapati would vary from 110 to 160. If a student consumes say 6 chapaties during the whole day, it would induce significant error in his daily calorie intake. Therefore it was essential to

weigh actual weights of foods consumed atleast for major items such as roti, rice which contributed significantly in the day's intake. Weigh as you eat method thus ensures greater accuracy, needed for studying variations in individual intake.

Table 2.6 : Average weight \pm standard deviation and coefficient of variation of chapati for 6 days in Round 1 in MSE.

Days	1	2	3	4	5	6
N	54	43	41	50	50	52
Avg. Wt. of chapati (Kg.)	57.78	55.81	61.34	51.40	50.50	55.87
S.D.	5.8	5.56	4.88	3.2	3.29	4.4
% C.V.	10.04	9.96	8.0	6.2	6.7	7.9

In this method, used for assessing dietary intake of the study population, nearly 85% of total daily intake was actually weighed. Remaining 15% came from food eaten outside the hostel and were estimated by using average weights of such items and estimated calorie and protein values in the laboratory.

Thus dietary intake of each individual in the study population was recorded with utmost care for 18 days, in case of adolescent boys from MSE group, and for 24 days in case of adolescent boys from LSE group, in the study period of one year. The reason for conducting diet survey 3 times in a year was to estimate seasonal variations in intake.